

currents caused by heating both a single metal and two metals in contact, and formulated the well-known thermoelectric series, bismuth, platinum, lead, tin, gold, silver, copper, zinc, iron, and antimony. In his studies on atmospheric electricity he proved that the water of the ocean and the solid crust of the earth are in opposite electrical conditions, a fact which explains the positive state of the air immediately above the sea, while at a distance from the ocean the positive change is noticeable only at a certain height above the earth. The physiological effects of the electric current formed likewise the subject of numerous observations, and by means of delicate apparatus he was able to demonstrate the development of minute currents by the various operations of life, the movement of the muscles, &c. In view of the purely chemical character of these operations these observations harmonised perfectly with the theory which he advanced that electric currents were produced by all chemical unions and decompositions.

The effects of electricity on the colours of flowers, he showed to consist chiefly in a mechanical bursting of the cells containing colouring matter, and not in a chemical change. The conductive powers of a number of elements and compounds for the electric current, as well as the thermal phenomena in bad conductors, formed likewise the subject of numerous investigations. In magnetism Becquerel's researches were confined chiefly to the demonstration of the ability of all bodies to be magnetised, and to the phenomena of terrestrial magnetism. His favourite field of discovery, and that in which he obtained the most brilliant results, was electro-chemical action; in the variety and value of his contributions in this department he is certainly surpassed by no other physicist, while he was the first to grasp and sum together the scattered observations, and fairly mould them into a science. In 1834 he observed the deposition of metal on the negative electrode when the two poles of a pile were introduced into solutions of the salts of various metals. Shortly after he discovered that by using feeble currents the metal could be deposited very evenly and equally on the surface of the electrode, and that the two solutions required for the purpose could be kept from mingling by the use of gold-beater's skin or animal membranes, without hindering the current. These facts were at once made use of by De la Rive, of Geneva, who based on them his technical process of gilding in 1840. Although not the first to make the practical application of his discoveries, Becquerel rapidly improved the methods derived from them, and contributed in swift succession an enormous number of facts which serve as the fundamental principles of the art of galvano-plastic. These are to be found in a compact state in Smee's Elements of Electro-metallurgy. Becquerel's famous *Oxygen-circuit*, discovered at this time, made his name known at once to a large circle, on account of its simple, practical quantities. It consists of a glass tube covered at one end with linen, which supports a layer of kaolin, and designed for the solution of the metallic salt to be reduced. This is placed in a vessel containing a dilute acid, and the object to be electro-plated is immersed in the solution after being connected by a wire with a platinum plate in the acid. The action begins instantaneously, and is both rapid and regular. Another well-known apparatus is his *depolariser*, an arrangement designed to obviate the reverse currents produced by the gaseous deposits on platinum electrodes, and consisting essentially in a continuous shifting of each of the plates to the liquid of the other, so that they have no opportunity to become polarised. The oxygen-circuit, with its gentle regular current, was used by Becquerel for the decomposition of a large variety of chemical compounds. Among the more noteworthy preparations by its action can be mentioned aluminium, silicium, beryllium, sulphur, and the various earthy and metallic phosphates. Equally extensive were the preparations of crystalline salts, notably those occurring in nature, by the action of the electric current on

mixed solutions or on solutions of soluble salts in contact with insoluble substances. During the past ten years his attention has been almost exclusively devoted to the novel and remarkable electro-capillary phenomena first observed by him in 1867. These can be observed in their simplest form when a cracked test-tube containing a solution of cupric sulphate, for example, is immersed in a solution of sodic sulphide. A deposition of metallic copper takes place at once on the crack. This elementary fact has been elaborated in a variety of directions with numerous solutions, and the laws regulating the development of electric currents by capillary action partially enunciated. The study of these phenomena is, however, still in its infancy. Becquerel regarded them as explanatory of the deposition of metals in veins in the rocks and of many physiological reactions taking place in the vegetable and animal tissues. A very detailed account of the experiments is to be found in vol. xxxvi. of the *Mémoires de l'Institut*.

Despite his manifold experimental investigations, Becquerel was an indefatigable author, and contributed a most valuable series of standard works to the physical literature of the past forty years. In the seven volumes of his "*Traité expérimental de l'Électricité et du Magnétisme, et de leurs Phénomènes naturels*," 1834-40, he presented these two sciences with a completeness and systematic arrangement which has been hitherto wanting in physical literature. This work was followed by "*Éléments d'Electro-Chimie appliquée aux Sciences naturelles et aux Arts*," 1843; "*Traité de Physique considérée dans ses Rapports avec la Chimie*," 1844, 2 vols.; "*Éléments de Physique terrestre et de Météorologie*," 1847; "*Traité de l'Électricité et du Magnétisme; leurs Applications aux Sciences physiques, aux Arts, et à l'Industrie*," 1856, 3 vols.; *Résumé de l'Histoire de l'Électricité et du Magnétisme*," 1858; and "*Des Forces physico-chimiques et de leur Interprétation dans la Production des Phénomènes naturels*," 1875.

In 1829 Becquerel was elected a member of the French Academy, and received in 1874 the *Medaille Cinquante-naire*, although he had been but forty-five years a member. His scientific communications are to be found in the *Comptes Rendus* of the Academy and in the *Annales de Chimie et Physique*. The Royal Society elected him as a corresponding member a number of years ago, and he was one of the three French *savants* who have been recipients of the Copley Medal. In 1865 Napoleon III. decorated him with the Cross of Commander of the Legion of Honour.

Prof. Becquerel leaves behind him a son, Edmond Becquerel, Professor of Physics in the Conservatoire des Arts et Métiers, who has assisted his father for a long series of years in the compilation of his numerous works, and whose researches in electricity fairly rival those of the latter. The funeral ceremonies took place on Monday in the church of St. Medard, at Paris.

DAVYUM¹

ABOUT the middle of this year (1877) I succeeded in isolating a new metal belonging to the platinum group. I named it Davyum, in honour of Sir Humphry Davy, the eminent English chemist.

The platiniferous sand from which it has been extracted²

¹ From an article by Sergius Kern in *La Nature*.

² The sand treated had the following composition:—

Platinum	...	...	...	...	...	...	80.03
Iridium	...	...	...	...	...	...	9.15
Rhodium	...	...	...	...	...	...	0.61
Osmium	...	...	...	...	...	...	1.35
Palladium	...	...	...	...	...	...	1.20
Iron	...	...	...	...	...	...	6.45
Ruthenium	...	...	...	...	...	...	0.23
Copper	...	...	...	...	...	...	1.02

100.09

O 2

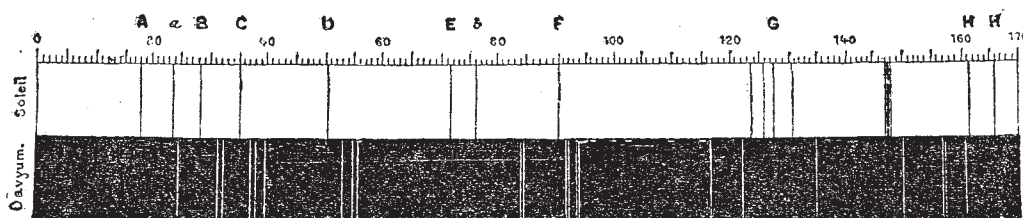
was treated, for the separation of the metal, by the analytical method of Prof. Bunsen. The mother-liquor obtained after the separation of the rhodium and iridium was heated with an excess of chloride of ammonium and nitrate of ammonium. A dark red precipitate was obtained after calcination at red heat. It yielded a greyish mass resembling spongy platinum. The ingot resulting from 600 grammes of mineral weighed 0.27 kil.

The metal was dissolved in aqua regia, in order to examine the action of different reagents on the solution. Potash gave a clear yellow precipitate of the hydrate of davyum, which is easily attacked by acids, even by acetic acid. The hydrate of davyum dissolved in nitric acid gave a brownish mass of nitrate of davyum; by calcining this salt a black product is obtained, which is probably the monoxide.

The chloride of davyum, dissolved in a solution of

potassic cyanide, gave, by gently evaporating the solution, beautiful crystals of a double cyanide of davyum and potassium. In this salt the potassium may be replaced by several metallic elements. The cyanodavie acid is very unstable; it is isolated by passing a current of sulphuretted hydrogen through a solution of the double cyanide of lead and davyum. Sulphuretted hydrogen produces, in the acid solutions of davyum, a precipitate of sulphide of davyum, which is easily attacked by the alkaline sulphides, yielding probably a series of sulpho salts.

A concentrated solution of chloride of davyum yields, with potassic sulpho-cyanide, a red precipitate, and when gently cooled, produces large red crystals. If the same precipitate is calcined the sulpho-cyanide of davyum takes the form of a black powder. These reactions show that this salt is allotropic.



Spectrum of davyum according to the data of Sergius Kern.

The chloride of davyum is very soluble in water, alcohol, or ether; the crystals of this salt are not deliquescent. The calcined salt gives the monoxide as a residue. Chloride of davyum forms double salts with the chlorides of potassium and ammonium. They are insoluble in water and very soluble in absolute alcohol. The double salt of sodium and davyum is almost insoluble in water and alcohol; this reaction is very characteristic, because many sodic salts of the platinum group are very soluble in water.

This chloride of davyum is the only one which exists, as the second product, containing more chlorine, is decomposed during the evaporation of the solution, disengaging chlorine.

I have made some new researches on the density of melted davyum; three experiments gave the following numbers:—9,383, 9,387, 9,392 at 24°. These results agree very sensibly with those of my first researches; the density

of davyum given in my first note to the Academy being 9,385 at 25°.

M. Alexejeff has undertaken the determination of the equivalent of davyum; but as the quantity of davyum which I possess is very small, exact researches are difficult. Preliminary experiments have shown that the equivalent is greater than 100, and probably about 150-154.

Some new platiniferous sands, which are to be placed at our disposal, will yield a sufficient quantity of the new metal for additional experiments. We hope to have in time nearly 12 gr. of davyum.

Finally I have investigated the spectrum of davyum by vaporising the metal in powder between the carbons of the electric lamp. The spectroscopist at my disposal is not powerful enough to show precisely all the secondary lines. This is why I have only indicated the principal lines easily visible in my spectroscopist.¹

THE GREAT DETONATING METEOR OF NOVEMBER 23, 1877

HAVING fully discussed the whole of the accounts of the great meteor that have reached me, consisting of some ninety direct communications and forty or fifty newspaper cuttings, I have the pleasure to forward to NATURE a condensed description of it.

The points of most importance to be determined are—

1. The true orbit which is obtained from a knowledge of the radiant and velocity of motion. 2. The height at which it first became luminous, as our knowledge of the real extent of the earth's atmosphere depends exclusively upon such determinations. 3. The height at which it exploded and came to an end. That this last is connected with the physical condition and constitution of the body cannot be doubted. The brightness of meteors seems always to depend upon the distance they penetrate into the air. Generally, when they get below 30 or 40 miles, they are very remarkable.

The Greenwich mean time was 8h. 24m. 30s. on November 23.

There are but few descriptions of the path of the great meteor in question from which to derive the radiant point. Five of the fully-described tracks meet almost

exactly in R.A. 62°, N.P.D. 69°. The others tend to support this position rather than to alter it, but many are, as is usual, extremely wild, passing 20°, and even 30° from it. To an observer situated near the middle of the north coast of Wales, this radiant would bear south 74° E., at altitude 37°.

The meteor first came visible to Mr. T. B. Barkas, at Newcastle-on-Tyne, to another observer at Tynemouth, to the Rev. G. Iliff, at Sunderland, and Mr. E. Pikard, at York, at the great height of 96 statute miles. The observers agree very closely. It is probable, of course, that had any one been actually looking in the right direction, it might have been seen a little earlier when it was still higher. A height exceeding 90 miles is certain. The meteor was then vertically over a point 13 miles north of Derby, and its appearance was that of an ordinary shooting star. Descending in the air at the inclination of 39° to the surface of the earth, when 48 miles exactly over Liverpool, it became intensely brilliant, so suddenly, that many observers speak of this as the first explosion.

It was at this instant that it attracted universal attention. People as far distant as Essex, Roscommon, Edinburgh, Bristol, and Queenstown, 200 miles from it,

¹ *Comptes Rendus and Chemical News.*